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yAbstract

Purpose: This is the first study in Africa to investigate the association of violence against children with human capital development, including short and long term health and educational outcomes in South Africa.

Method: Hypotheses were tested by applying logistic regressions, zero inflated poisson regressions and linear regressions with a large and representative sample of adolescents from the Cape Area Panel Study (CAPS). Household fixed effects model and treatment-effects model were performed to check the robustness of the results.

Results: Analyses indicate that 58% of adolescents in South Africa have experienced physical or emotional violence in childhood. All forms of violence, especially physical violence, are associated with adverse physical and mental health, poorer academic achievement and lower education level of the victims in both the short and long term. Adolescent males who have experienced violence in childhood are more likely to report poorer educational outcomes and long term physical health, while female victims are at higher risk of mental illness.

Conclusions: The findings provide support for the negative effects of violence against children on health and educational outcomes, which lead to increasing inequalities that impact on the future development of South Africa. Urgent violence against children prevention programming is needed alongside health and educational initiatives in the country.

Keywords: Violence against children, Human capital, Health, Education, South Africa

Violence Against Children and Human Capital in South Africa

Violence against children (VAC) is an important global public health problem, regardless of gender, age, class, income, culture and ethnic origin (UNICEF, 2015). In South Africa, children experience high levels of violence (Hsiao et al. 2018). According to a recent systematic review and meta-analyses (including 65 studies), 26.1% of South African children had experienced physical violence (24.0% for males and 28.7% for females) and 12.6% emotional violence (9.7% for males and 16.2% for females) in their lifetime (Fang et al. 2016). Past research has demonstrated that VAC may result in adverse physical, emotional, behavioral, cognitive and social effects on victims (Corso et al. 2008; Hong et al. 2014; Hong et al. 2015; Hong et al. 2017; Lin et al. 2011; Kaminsk and Fang, 2009), all of which may jeopardise their human capital development. According to the OECD, human capital is defined as people's skills, learning, talents and attributes (OECD 2007) and this plays a significant role in the well-being of individuals, families, organizations and countries with the effect that even low levels of human capital can lead to reduced economic growth (Fang et al. 2012; Fang et al. 2017; Huang and Mossige 2012).

Health and education are the two major factors of human capital which have been extensively studied and theorized across several decades of research (Crocker 2006; Lutz et al. 2017; Fitzsimons 2015). On the one hand, health is a direct determinant of human well-being and dictates the degree of productivity, as well as contribution to work and society (Liu et al. 2008). On the other hand, education is regarded as a primary channel through which individuals gain knowledge and skills and hone capabilities to contribute positively to the value of human capital (Lauder 2015). In the last two decades, a number of researchers studied the effect of VAC on health and educational consequences in developed countries. In a global systematic review, Gilbert et al. (2009) reported that childhood abuse is strongly associated with obesity, sexually transmitted disease and chronic pain of the adolescent

vicims. A quarter to a third of abused children exhibited depression in their late 20s and in the United States, 80% of young adults who had been abused in childhood experienced one or more forms of psychiatric disorders by the age of 21. Another global systematic review focusing on the impacts of violence in childhood on educational outcomes found that all forms of violence – physical, sexual and emotional violence – impact significantly on educational attainment and outcomes such as absenteeism for both boys and girls albeit in different ways (Fry et al. 2018). However, to our knowledge, few studies have comprehensively discussed the association of VAC with human capital in African context.

To fill the research gap, the purpose of the present study is to examine the association of VAC with human capital, including short and long term health and educational consequences, from a representative sample of South African adolescents. We further explored gender differences in this relationship and checked the robustness of our results by applying household fixed effects and treatment-effects models. Our findings are intended to help policy makers better understand the negative impact of the VAC on human capital in South Africa and advance their awareness to support investments for prevention and intervention programs to reduce the prevalence of VAC and to provide appropriate responses to those who have experienced violence.

Violence against children and human capital

Violence against children can cause negative consequences to the health status of the victims in several ways. Physical injuries sustained from abuse are the most obvious signs of physical abuse and in addition to short term consequences such as bruises, scars, burns, and dislocation, long term consequences such as recurrent illness, permanent scarring, disabilities and body deformations are also possible (Finkelhor 2008; Greenfield 2010). Furthermore, in more severe cases, physical violence can result in loss of memory, permanent brain damage, mental disorders, suicidal tendencies and premature death of the victims (Bicakci 2016; Mills

et al. 2013). The negative impacts of emotional violence has also been reported to result in debilitating long term consequences such as self-inflected harm, hyper- and high-risk sexuality, intimate partner violence (IPV), impulsivity, substance use, low self-esteem, impaired cognitive capacity, emotional upset, fear and post-traumatic stress disorder and suicide ideation and attempts (Downey et al. 2017; Fang and Corso 2008; Fang et al. 2015; Herrenkohl et al. 2013).

With respect to the mechanism of the relationship between VAC and educational outcomes, children who suffered from one or more forms of abuse may have difficulty in concentrating on academic activities, gaining new knowledge, acquiring new developmental skills and find it difficult socializing within environments such as schools, resulting in disrupted academic development (Romano et al. 2015; Trout et al. 2008). Moreover, the poor academic levels of abused children could be attributed to the children constantly delegating time and energy towards mentally or physically avoiding abuse, thus leaving them with minuscule amounts of physical or intellectual energy to delegate to academic responsibilities (Nakamoto et al. 2010; UNESCO 2017). Therefore, in the short term, children who have suffered from violence are more likely to have poorer academic performance, grade retention, less school connectedness and attendance, in comparison to children who have not been the victims of such violence (Mills et al. 2011). In the long term, children who have experienced violence in childhood have higher probability of not graduating from school and lower schooling years (Basch 2011; Fry et al. 2018).

Although adolescents may experience similar adverse effects to trauma from childhood violence, previous studies have suggested distinctions of coping responses between males and females (Gallo et al. 2018; Maschi et al. 2008). Specifically, adolescent males tend to react to stress by externalizing their behavior to express anger and act out aggressively, while females often internalize their behavior and therefore have higher levels of feelings of

guilt, depression and anxiety (Brensilver et al. 2011; Dunn et al. 2012). As such, on the one hand, compared to their female counterparts, male adolescents are more likely to engage in risky behaviors, such as alcohol or substance abuse, and delinquency or criminality, which are detrimental to their physical health, academic achievement and education levels (Bask 2015; Holt et al. 2008; Maschi et al. 2008). On the other hand, the negative association between VAC and mental health may be stronger for female victims than their male counterparts (Brensilver et al. 2011; Dunn et al. 2012; Hanson et al. 2008; Iverson et al. 2013).

Hypotheses

To summarize, VAC is an important risk factor of human capital and the effect of childhood violence might be different between males and females. We intend to test the associations and its gender differences of VAC with short and long term health and educational outcomes among South African adolescents. The specific research hypotheses are as follows:

H1: Adolescent victims of childhood violence will have lower levels of physical and mental health in the short and long term.

H2: Adolescent victims of childhood violence will have poorer academic achievement and lower education levels.

H3: The association between VAC and physical health will be stronger for adolescent males, while female victims will have poorer mental health.

H4: The association between VAC and educational outcomes will be larger for adolescent males.

Methods

Participants and Procedures

We tested our hypotheses by using data from Wave 1(2002) and Wave 5 (2009) of Cape Area Panel Study (CAPS). CAPS is a longitudinal study which focused on the lives of youth and young adults in metropolitan Cape Town and spans 5 waves with studies conducted from 2002 to 2009 (Lam et al. 2012). The CAPS household sample was drawn through a two-stage process. First, a sample of primary sampling units (PSUs) was selected within each population group stratum with probability proportional to size. Second, a sample of 25 screener households was drawn within each PSU and the adolescents aged 14-22 in each selected family were the respondents in Wave 1. For the complete survey sampling design, please see Lam et al. (2012). We used data from Wave 1 to study the short term association between VAC and human capital and merged Wave 5 data to Wave 1 to investigate the long term relationship. Wave 1 collected interviews from 4752 adolescents (response rate: 89.6%) who were asked to recall their childhood abuse. Nearly three thousand (n=2915) respondents were successfully followed in Wave 5 when the age of young adults was 21–29 year-old (Lam et al. 2012). We excluded the observations which have missing values on key variables, resulting in a final sample size of 4724 cases for short term analyses and 2900 cases for long term analyses. The mean age for the sample in Wave 1 was 17.87 years (SD=2.48), The adolescents were predominately female (55%), Black (45%) and Coloured (42%). One-fifth (20%) of household heads were female and 39% of families' home language was English. The mean household size and monthly family income per capita was 5.43 (SD=2.52) and 1164.31 South African Rands (ZAR), respectively. The average education level of the adolescent's mother was 8.89 years of schooling (SD=5.44).

Measures

Violence against children

The indicators related to VAC are early life retrospective questions from Wave 1 of CAPS data in 2002. Respondents were asked to reflect on their family life until 14 years of age. The questions of VAC were how often a perpetrator (the perpetrator could be a parent, stepparent, or adult living in their homes) : "swear at you, insult you, or put you down" (*put down*), "made you afraid that you might be physically hurt" (*afraid of hurt*), "push, grab, slap, or throw something at you" (*push*), "hit you so hard that you had marks or were injured" (*hit hard*). Respondents were asked to report on a five–point scale to measure the frequency of childhood abuse (before the age of 14): never, only once, sometimes, often, very often. We firstly generated 4 dummy variables of VAC to measure childhood abuse experience. They were *put down*, *afraid of hurt*, *push* and *hit hard*. These dummies were coded 0 if the respondent answered "never", otherwise they were coded 1. Following Chapman et al. (2004) and Dube et al. (2003), *put down* and *afraid of hurt* were regarded as emotional violence, while *push* and *hit hard* were considered as physical violence. Therefore, we further generated 3 dummies, namely, *physical violence* (yes=1, no=0), *emotional violence* (yes=1, no=0) and *overall violence* (yes=1, no=0), to represent the corresponding type of VAC.

Table 1 shows the unweighted and weighted descriptive statistics for VAC in Wave 1 of CAPS, with *t*-tests by gender. It can be seen that the unweighted and weighted estimates are very close and we refer to the weighted statistics whenever means are discussed. The overall prevalence of VAC is 58%. 34% of the adolescents have been physically abused, and 53% have been emotionally abused, showing a disproportionally high level of childhood violence in South Africa. Compared with males, a significant higher proportion of females have been been emotionally abused (*afraid of hurt*) in childhood.

Human capital: health and educational outcomes

The measures of the short and long term health outcomes are overall health, physical health and mental health. First, *self-rated health* is an overall health indicator from Wave 1 and Wave 5, which measures: "In general, how is your health? Would you say it is excellent, very good, good, fair or poor?" The self-rated health dummy was coded 1 if the respondent answered "excellent", "very good" or "good", otherwise it was coded 0. Because the categorization of the variable relies on researcher decision-making, we also applied different recoding strategies on self-rated health measure (for example, we counted "good" as "0") and found similar results. Second*, health problems* is a physical health indicator from Wave 1 and Wave 5, which measures: "Do you have any health problems or disabilities?" The health problems were constrained to physical health problems, including physical disabilities, problems with respiratory function and sight, hearing and speech. If the answer was "Yes", then the dummy variable was coded 1. Third, *Mental illness* in the past 30 days was measured by the Kessler Psychological Distress Scale (K6) in Wave 5, which consists of six questions to assess a respondent's general mental health, including feelings of being "nervous", "hopeless", "restless", "depressed", "every thing was an effort" and "worthless" (Kessler et al. 2009). Each response was given a possible score between 0 (none of the time) and 4 (all of the time) and summed up for a total K6 score, ranging from 0 to 24. The higher the K6 score, the poorer the respondents' mental health. Although Wave 1 had a question in relation to mental problems, it was not included in this study because too few respondents (less than 1%) answered "Yes", which were not representative enough to analyse the short term effect of VAC on mental health of the victims.

The measures of the short and long term educational outcomes are test scores and education level, respectively. The test score indicators are from Wave 1, whereas the indicator of education level is from Wave 5, when most young adults were graduated from

school and had a job. The respondents in Wave 1 had taken a literacy and numeracy evaluation test (completed in Afrikaans or English) in 4 sections with 45 questions. We generated 3 variables to measure the short term academic achievement. The first, *total test score*, is an indicator that sums the respondent's literacy score and numeracy score, which ranges from 0 to 45. Second, *literacy score* is a variable created from the evaluation of literacy questions in the test and it ranges from 0 to 22. Third, *numeracy score*, is a variable created from an evaluation of numeracy questions in the test and it ranges from 0 to 23. A higher test score represents better academic achievement. *Education level* is a continuous variable from Wave 5, which measures the years of education a respondent completes to represent long term educational outcomes. The question of this indicator is "What is the highest education level completed?" and the answers were converted to schooling years according to the length of schooling for different education levels in South Africa.

Table 2 presents the unweighted and weighted descriptive statistics of health and educational outcomes, with the *t*-tests by gender. The weighted statistics show that 93% of young adults in Wave 1 and 40% in Wave 5 thought their health status were "good", "very good" or "excellent", indicating a quick decrease on self-rated health. There were 10% of respondents in Wave 1 and 6% in Wave 5 who had at least one physical health problem. The average mental illness (K6) score was 4.36 and females had poorer mental health than males. Overall, the average education level of the respondents in our sample was 11.05 years of schooling in Wave 5. In terms of gender differences, compared with males, females had more physical health problems, more severe mental problems, lower numeracy score, but higher literacy score and schooling years.

Demographic Controls

Previous studies have showed that various factors are associated with child human capital development. Following Case et al. (2002) and Currie (2009), individual

characteristics and family socioeconomic background in Wave 1 were included in our analyses as control variables. They are gender (dummy variable coded 1 for male), ethnicity (two dummy variables, including *Black* and *Coloured* to represent 3 types of race), *age* (measured in years), *home language* (coded 1 for English), *household size* (number of family members), *female-headed household* (coded 1 for yes), *mother's education level* (measured in years) and *per capita income* (measured family monthly income per capita in South African Rand). The unweighted and weighted descriptive statistics of control variables are shown in Table 3.

Analyses

The following regression estimations were performed to obtain the associations of VAC with health and educational outcomes. First, for health outcomes, all measures of health except mental illness (K6) are binary, logistic regressions were used for these binary health outcomes. Mental illness score ranges from 0 to 24 with over 50% zero counts and the mean (5.06) and deviation (4.85) of the variable are relatively close. Therefore, zero inflated poisson (ZIP) model, which is a mixture of Poisson count model and the logistic model for predicting excess zeros, was used to prevent potential biased estimation of parameters due to extra zeros in the data (Lee et al. 2006; Yoon et al. 2015). Vuong's tests were performed in the analyses to demonstrate whether ZIP was superior compared to regular Poisson regression. Second, for educational outcomes, linear regressions were applied and Ordinary Least Square (OLS) was used as an estimating method because all measures were continuous. The four educational outcomes were standardized to zero mean and unit variance (z-score) to better interpret the regression estimates and deal with possible problem of outliers. Specifically, "$z=\pm 3$ rule" was used to identify outliers. Specifically, any z-score greater than 3 or less than -3 was considered to be an outlier (Osborne, 2010). Instead of excluding these outliers (less than 1% for each educational outcome), we winsorized them to 3 or -3 to obtain

the full information of the sample as far as possible. To control for false discovery rates due to multiple testing, we adjusted significance level of p-values as recommended by Benjamini and Hochberg (1995) in the above regressions to minimize the possibility of Type I error.

Robustness checks

Household fixed effects model

The estimated associations between VAC and health and education might be biased if there exists endogeneity problems. The main sources of endogeneity are reverse causality and omitted variables. Among them, reverse causality problem is not likely to happen in this study because the VAC had happened before the questions in regard to health and educational outcomes were asked. However, unobserved factors such as children's delinquent behaviors may simultaneously result in childhood violence and poor health and educational outcomes. Bias may also arise if the parents who abused children also failed to provide good medical resources and educational opportunities. On account of this, we firstly applied household fixed effects model and added a vector of household dummies and sibling dummies to control for the constant and unmeasured family background between and within families that could possibly be correlated with both VAC and health and educational outcomes (De Neve and Oswald, 2012). However, household fixed effects model is unable to address any transitory family shocks, for example, experiences such as parental un- and under-employment and divorce. Furthermore, the household fixed effects model is also unable to account for sibling characteristics, such as twin pairs, full-siblings, half-siblings, or unrelated siblings raised together. These omitted factors may cause selection bias.

Treatment-effects model

To correct potential sample selection bias, we further used treatment-effects model with household fixed effects to investigate the effect of VAC on the human capital of the victims. The treatment-effects model is a widely used method in such fields as evaluation

research. The method is used for data where a subset of non-randomly selected cases received a treatment. There are two stages in treatment-effects model, namely, treatment equation and outcome equation. The aim of treatment equation is to predict the probability of exposure to a specific condition (*i.e.,*VAC) and compute correction factors (*anthrho* and *lnsigma*) for the estimation of outcome equation, which is to examine the factors that affect the dependent variable (*i.e.,* human capital indicators). In this study, VAC is the treatment variable, which is assumed to be determined according to the following rule: VAC=1 when the predicted value of VAC is above zero, otherwise VAC=0. Maximum likelihood estimation (Maddala 1983; Meada 2008) and two-step estimation (Green 2008) are the two methods to perform the treatment-effects model. To obtain more robust estimates, maximum likelihood estimation (MLE) was applied in this study..

A key assumption of the treatment-effects model in the present study is the correct prediction of the probability of childhood abuse in treatment equation. Therefore, it is important to find appropriate factors to explain and predict VAC probability. Previous research has shown that adverse family environment conditions and key background variables are crucial determinants of the likelihood of VAC. For example, family members who abuse alcohol or substances are at a higher risk of being perpetrators of VAC (Murphy et al. 1991; Putnam 1997; Maternowska et al. 2017). Therefore, the covariates in treatment equation include whether the respondent lived with someone in the household who was a problem drinker or alcoholic (*Problem Drinker*), used illicit drugs (*Drug user*), was mentally ill or depressed (*Mentally ill*) and spent some time in a jail or prison (*In jail*), when the adolescents were growing up (up to age 14). Furthermore, the demographic controls were also used to explain whether a respondent was abused in childhood.

Results

Violence against children and human capital: health outcomes

Table 4 presents the estimating results of the logistic regressions and ZIP regressions with different measures of VAC. To economise on space, we present the full set of coefficients for the aggregate measures of VAC only. Each model controls variables related to the dependent variable and odds ratio (or incidence rate ratios), 95% confidence intervals, pseudo-R-squared and observations of each model are reported in the table. The estimating results show that, all measures of VAC are significant in column (1) and (2), implying that any experience of violence in childhood is associated with poorer self-rated health and higher probability of physical health problems in the short term. Comparatively, physical violence has larger negative effect on the victims' self-rated health (odds ratio=0.717, $p<.01$) and positive effect on physical health problems (odds ratio=1.345, $p<.01$) . All measures of VAC are not significant in column (3), indicating that childhood abuse may have no large effect on the long term self-rated health of the victims. However, physical violence indicators are significantly associated with higher probability of health problem in column (4) and all measures are significantly correlated with more severe mental illness in column (5), which shows that VAC can also cause negative consequences on health, especially mental health in the long term.

Violence against children and human capital: educational outcomes

Table 5 presents the estimating results of OLS regressions with different measures of VAC. The distributions of residuals of each regression are asymptotic normality, which meets the distribution assumption, Column (1) shows that all measures of VAC are negatively significant except *put down*, which implies that any experience of physical or emotional violence in childhood can significantly decrease the *total test score* of children in the short term. Comparatively, the estimated coefficients show that physical violence has more severe

educational consequences. Column (2) and column (3) present negative associations of VAC with *literacy score* and *numeracy score*..The results show that being *pushed* and *afraid of being hurt* in childhood will significantly decrease the *literacy score* and all measures of VAC, especially physical violence, have significant and negative correlation with *numeracy score* of the victims. Column (4) reports that all indicators of VAC, particularly physical violence, are negatively significant, showing negative relationship between VAC and long term education level

Violence against children and human capital: gender difference

We further investigated the gender difference of the relationship between VAC and human capital. The results are presented in Appendices A.1 and A.2 (available at https://drive.google.com/open?id=1lLA6okJYqp19_OMipxqWzTiVSGS0jnYR). From the perspective of health measures, estimated results demonstrate more significant associations between VAC and females' short term self-rated health and physical health problems. For example, the estimated correlations of emotional violence on female's short term self-rated health are significant in column (6) (odds ratio=0.563, p<.001) and column (7) (odds ratio=1.404, p<.05), while the relationships for males are not significant. In the long term, a larger negative association of VAC with physical health seems to be driven by males in the sample (*overall violence*, odds ratio=2.392, p<0.001), while the association between childhood violence and mental health is stronger for females (*overall violence*, relative rate ratio=1.137, p<0.01). From the perspective of educational outcomes, results show that the estimated associations between *overall violence* in childhood and short term *total test score, literacy score and numeracy score* are larger for males than females. In the long term, no matter physically or emotionally, VAC also has stronger significant and negative association with education level for adolescent male victims. Overall, males who have been maltreated in

childhood are more likely to have lower learning ability and higher probability to drop out from school in their later adolescent years.

Robustness checks

As discussed in the previous sections, the estimates of VAC could be biased in the logistic, ZIP or OLS regressions if endogeneity problems exist. To address these potential problems, we applied household fixed effects model and treatment-effects model to check the robustness of the previous estimates. The Appendices A.3 to A.6 (available at https://drive.google.com/open?id=1lLA6okJYqp19_OMipxqWzTiVSGS0jnYR) present the estimated effects of VAC on health and educational outcomes, respectively. First, The results of household fixed effects model show that, after controlling for the time invariant household and sibling characteristics, the estimated odds ratios, incidence rate ratios and coefficients of all measures of VAC on health and educational outcomes in the regressions are in close proximity to previous estimates, indicating that our results are robust. Second, the results of treatment-effects model (with household fixed effects) show that the adverse family environment (including *problem drinker, drug user, mentally ill, in jail*) is significantly associated with higher probability of experiencing maltreatment in childhood. The estimates of *athrho* and *lnsigma* are significant in the most of the regressions, regardless of measurement of health and educational outcomes, which implies that the estimates of VAC in previous regressions are possibly biased. However, the direction and significance level of the estimated coefficients of *physical violence*, *emotional violence* and *overall violence* are almost the same as corresponding previous estimates on the associations between VAC and health and educational outcomes. In some cases, the significance level of VAC measure are even higher in treatment-effects models, which indicate that, to a certain extent, our estimates of the association between VAC and human capital in South Africa in the previous

regressions are conservative and the prevention of VAC and interventions to reduce the negative effects of childhood violence are in more urgent need.

Discussion

This is the first study to comprehensively discuss the association between violence against children and human capital in African context. The aim of the present study was to explore the short and long term health and educational consequences of childhood violence in South Africa. Specifically, this research used data from the Cape Area Panel Study (CAPS) and sought to examine whether adolescents who were abused in childhood are more likely to have lower levels of physical health, mental health, academic achievement and education levels, if so, what were the differences of the associations between males and females.

Our analyses indicated that physical violence, emotional violence and overall violence in childhood are reported by 34%, 53% and 58% of respondents, respectively. Congruent with the first and second hypotheses and previous studies, our results showed that all forms of violence are associated with adverse physical and psychological health, poorer academic achievement and lower education levels of victims in both short and long term (Fang et al. 2015; Herrenkohl et al. 2013; Mills et al. 2011; Norman et al. 2012; Romano et al. 2015;). In addition, our findings suggested that, compared with emotional violence, physical violence is even more detrimental to the health and educational outcomes of the adolescent victims echoing findings from other global regions (Fang et al. 2017; Fry et al. 2018). Negtive long term mental health outcomes are more significantly associated with VAC than physical health, which implies that childhood abuse has larger long lasting effects on psychological health of the victims (Gilbert et al. 2009).

In line with our third and fourth hypotheses, this study found that VAC has stronger association with long term physical health for males and mental health for females. Adolescent males who have experienced abuse in childhood are more likely to have poorer

numeracy and literacy skills as well as lower long term education levels. These results are consistent with the literature regarding gender differences on the sensitivity and ways of coping with stress caused by adverse childhood experience (Brensilver et al. 2011; Gallo et al. 2018; Maschi et al. 2008). However, different from some past research, our results suggested a stronger relationship between childhood violence and short term females' physical health. A possible reason is that girls are more likely to be exposed to violence than boys (Dunne et al. 2012), as the descriptive statistics of violence exposure showed that the prevalence of childhood violence, especially emotional violence was higher for females than their male counterparts. It is also possible that adolescent females have poorer short term health in our sample (as demonstrated in the summary statistics of health measures), which make them more vulnerable to be affected by the experience of childhood violence.

The findings from this study have several implications for research and practice. In terms of research implications, as suggested in the results of our study, VAC has significantly negative association with human capital in South Africa. Future research can further investigate the effects of childhood abuse on the young adults' employment status and economic well-being, as well as test the contribution of the mediating effects of health and education. We also encourage future studies to test the pathways of gender differences of the relationship between childhood violence and human capital by examining the externalizing and internalizing behaviour for males and females in African context. In terms of implications for practice, as VAC is currently not regarded as a significant human rights or public health issue in South Africa (Hsiao et al. 2018), setting up laws and rules for banning violent punishment of children by parents, teachers or other caregivers is in urgent need. More efforts are also required to prevent VAC by building the parenting capacity of parents and caregivers through parenting and caregiver support programs and cash transfer programs as strategies that has been proven to be effective at preventing VAC (WHO 2016). Examples

of successful parenting programs already exist in South Africa and these can be expanded to reach larger populations (Cluver et al. 2017). Moreover, much like efforts to curb VAC at home, endeavours within the school environment focused on whole school approaches that span training and support from initial teacher education to governance within schools settings for addressing both violence prevention (both within and outwith school settings) and making appropriate referrals for violence that occurs in other settings that may come to the attention of teachers and school personnel is essential. Additionally, a dedicated national policy is urgently required, aimed at providing sufficient, subsidised healthcare services to children at risk and special education and rehabilitation services for victims of violence.

Limitations

Despite the contributions and implications for the family violence literature, the limitations of this study also warrant mentioning. First, it is possible that there exists measurement errors for determining VAC. One possible measurement error is that the prevalence of different types of childhood violence are underreported in the retrospective survey questions. The respondents may be unwilling to disclose such private information or they may suppress violence experienced in childhood, or even not recognize what they experienced as a child was actually abuse. The measurement error of VAC may result in underestimation of the association of childhood violence with health outcomes in South Africa. Second, due to the lack of data on other types of VAC, sexual violence and neglect, which also constitute forms of VAC, were not included and discussed in this study. Future studies would benefit by also including these types of VAC and considering the disparities on the effects of different violence measures on health and educational outcomes and any gender differences. Moreover, although we used 9 measures to represent the short and long term health and educational outcomes, the relationship between VAC and short term mental health was not investigated in this study due to the unavailability of the outcome variable, which is

also needed to be accounted in future studies. Third, in spite of the large sample size in this study, the response rate in Wave 5 of CAPS data is 61.3% of the sample in Wave 1. According to the officially released technical documentation of the CAPS, high non-response rate among the sample, especially the white population is a common issue facing surveys in South Africa (Lam et al. 2012). The most common reason of non-response in this study is respondents moving out of Cape Town area. Consequently, researchers should be cautious in making generalizations from our findings of long term analyses. More relevant studies are needed to further strengthen the understanding of the effect of VAC on human capital and raise the awareness of protection of children and preventing VAC before it ever starts.

Conclusions

This study contributes to family violence literature by highlighting the associations of VAC and human capital in South Africa. We found significant and negative relationships between childhood violence, especially physical violence and physical health, mental health, academic achievement and education level of the adolescent victims. Furthermore, findings of the present study showed that adolescent males who have experienced violence in childhood are more likely to have poorer educational outcomes and long term physical health, while female victims are at higher risk of mental illness. As noted by Doodge (2007) and Pettinger (2017), the development of an individual through childhood, particularly with respect to health and education, plays a significant role in their ability to contribute positively to their environment, determines their human capital value and ultimately determines the growth and development of the environment as well. With VAC reported to be prevalent and impacting the physical and psychological well-being of children with short term consequences in childhood and long term consequences in adulthood, addressing this problem with strategies to prevent VAC is an essential endeavour in improving the health and well-being of children and improving the value of their human capital as well.

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Table 1

Descriptive statistics of violence against children, Wave 1

Variable	Mean (sample)	Mean (weighted)	Gender			Sample size
			Male	Female	*t*-test	
Put down	0.48	0.50	0.47	0.49	-1.56	4724
Afraid of hurt	0.27	0.26	0.26	0.29	-2.05**	4724
Push	0.31	0.32	0.30	0.31	0.45	4724
Hit hard	0.12	0.13	0.12	0.12	-0.75	4724
Physical violence	0.33	0.34	0.33	0.33	0.33	4724
Emotional violence	0.52	0.53	0.51	0.53	-1.28	4724
Overall violence	0.57	0.58	0.56	0.58	-0.99	4724

Notes. Statistics in *t*-test column are *t* values. Population means are weighted with survey design effects of individuals clustered in sampling units of enumeration areas (EAs) and stratification of major population groups in Cape Town.

*** p<0.01, ** p<0.05, * p<0.1.

Table 2

Descriptive statistics of health and educational outcomes

Variable	Wave	Mean (sample)	Mean (weighted)	Gender			Sample size
				Male	Female	*t*-test	
Health							
self-rated health	Wave1	0.93	0.93	0.95	0.91	4.05***	4724
Health problem	Wave1	0.10	0.10	0.09	0.11	-1.62	4697
self-rated health	Wave5	0.39	0.40	0.40	0.37	1.64	2900
Health problem	Wave5	0.07	0.06	0.05	0.08	-3.66***	2886
Mental illness (K6)	Wave5	5.06	4.36	4.58	5.46	-4.86***	2900
Education							
Total test score	Wave1	26.83	28.78	26.99	26.70	1.09	4683
Literacy score	Wave1	17.10	17.82	16.94	17.21	-2.36**	4683
Numeracy score	Wave1	9.73	10.95	10.04	9.48	3.25***	4683
Education level	Wave5	10.91	11.05	10.71	11.08	-4.49***	2900

Notes. Statistics in *t*-test column are *t* values. Population means are weighted with survey design effects of individuals clustered in sampling units of enumeration areas (EAs) and stratification of major population groups in Cape Town.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3

Individual and household characteristics, Wave1

Variable	Mean (sample)	Mean (weighted)	Standard deviation	Sample size
Individual characteristics				
Male	0.45	0.48	0.50	4724
Black	0.45	0.28	0.50	4724
Coloured	0.42	0.53	0.49	4724
White	0.13	0.19	0.33	4724
Age	17.87	17.91	2.48	4724
Family socioeconomic background				
Home language English	0.20	0.29	0.40	4724
Household size	5.43	5.31	2.52	4724
Female-headed household	0.39	0.37	0.12	4724
Mother's education level (years)	8.89	9.68	5.44	4322
Mother's education missing	0.08	0.08	0.28	4724
Per capita income (Rands)	1164.31	1570.37	2041.87	4724

Notes. Statistics in *t*-test column are *t* values. Population means are weighted with survey design effects of individuals clustered in sampling units of enumeration areas (EAs) and stratification of major population groups in Cape Town.

*** p<0.01, ** p<0.05, * p<0.1.

Table 4

Regressions of violence against children and health outcomes

Variables	Short term		Long term		
	(1)	(2)	(3)	(4)	(5)
	self-rated health	Health problem	self-rated health	Health problem	Mental illness (K6)
Put down	0.630***	1.184*	1.02	1.102	1.062***
	[0.501, 0.791]	[0.974, 1.439]	[0.876, 1.189]	[0.817, 1.487]	[1.027,1.097]
pseudo-R^2	0.021	0.016	0.012	0.016	—
Observations	4724	4697	2900	2886	2900
Afraid of hurt	0.738**	1.208*	1.056	1.238	1.102***
	[0.582, 0.935]	[0.977, 1.493]	[0.893, 1.250]	[0.902, 1.699]	[1.064,1.141]
pseudo-R^2	0.017	0.016	0.012	0.017	—
Observations	4724	4697	2900	2886	2900
Push	0.727***	1.408***	0.936	1.354*	1.084***
	[0.576, 0.917]	[1.152, 1.722]	[0.794, 1.104]	[0.992, 1.850]	[1.046,1.124]
pseudo-R^2	0.017	0.019	0.012	0.018	—
Observations	4724	4697	2900	2886	2900
Hit hard	0.584***	1.583***	1.13	1.593**	1.133***
	[0.434, 0.785]	[1.215, 2.061]	[0.902, 1.416]	[1.070, 2.373]	[1.080,1.190]
pseudo-R^2	0.019	0.019	0.012	0.019	—
Observations	4724	4697	2900	2886	2900
Physical violence	0.717***	1.345***	0.984	1.304*	1.077***
	[0.570, 0.902]	[1.102, 1.642]	[0.837, 1.157]	[0.958, 1.776]	[1.039,1.115]
pseudo-R^2	0.018	0.018	0.012	0.018	—
Observations	4724	4697	2900	2886	2900
Emotional violence	0.629***	1.229**	1.053	1.272	1.088***
	[0.499, 0.793]	[1.009, 1.495]	[0.903, 1.227]	[0.940, 1.722]	[1.052,1.125]
pseudo-R^2	0.021	0.017	0.012	0.018	—
Observations	4724	4697	2900	2886	2900
Overall violence	0.630***	1.327***	0.986	1.238	1.093***
	[0.496, 0.800]	[1.085, 1.625]	[0.844, 1.153]	[0.908, 1.686]	[1.056,1.130]
pseudo-R^2	0.021	0.018	0.012	0.017	—
Observations	4724	4697	2900	2886	2900

Notes. Odds Ratios (OR) in column (1) to column (4) are from logistic regressions and Incidence Rate Ratios (IRR) in column (5) are from zero inflated poisson (ZIP) regressions; 95% confidence intervals calculated by Huber-White robust standard errors in brackets. Each coefficient comes from a separate regression.Regressions with all controls include the following: *Male, Black, Coloured, Age, Home language English, Household size, Female-headed household, Mother's education level, Mother's education missing, Per capita income (Rands).*

* p<0.1, ** p<0.05, *** p<0.01

Table 5

OLS regressions of violence against children and educational outcomes

Variables	Short term			Long term
	(1) Total test score	(2) Literacy score	(3) Numeracy score	(4) Education level
Put down	-0.029	0.002	-0.046**	-0.093***
	[-0.074, 0.017]	[-0.047, 0.052]	[-0.091, -0.001]	[-0.161, -0.024]
R^2	0.387	0.266	0.395	0.142
Observations	4683	4683	4683	2900
Afraid of hurt	-0.073***	-0.054*	-0.077***	-0.111***
	[-0.125, -0.021]	[-0.111, 0.004]	[-0.128, -0.026]	[-0.185, -0.037]
R^2	0.388	0.266	0.396	0.142
Observations	4683	4683	4683	2900
Push	-0.083***	-0.064**	-0.085***	-0.171***
	[-0.132, -0.033]	[-0.118, -0.010]	[-0.134, -0.036]	[-0.244, -0.098]
R^2	0.388	0.267	0.396	0.146
Observations	4683	4683	4683	2900
Hit hard	-0.110***	-0.06	-0.129***	-0.113**
	[-0.181, -0.038]	[-0.138, 0.019]	[-0.200, -0.059]	[-0.212, -0.013]
R^2	0.388	0.266	0.397	0.141
Observations	4683	4683	4683	2900
Physical violence	-0.078***	-0.055**	-0.084***	-0.154***
	[-0.126, -0.030]	[-0.107, -0.002]	[-0.132, -0.036]	[-0.226, -0.082]
R^2	0.388	0.266	0.396	0.145
Observations	4683	4683	4683	2900
Emotional violence	-0.039*	-0.006	-0.055**	-0.097***
	[-0.084, 0.007]	[-0.055, 0.044]	[-0.101, -0.010]	[-0.166, -0.028]
R^2	0.387	0.266	0.396	0.142
Observations	4683	4683	4683	2900
Overall violence	-0.052**	-0.017	-0.069***	-0.123***
	[-0.098, -0.006]	[-0.067, 0.033]	[-0.114, -0.023]	[-0.194, -0.052]
R^2	0.388	0.266	0.396	0.143
Observations	4683	4683	4683	2900

Notes. Each coefficient comes from a separate OLS regression.95% confidence intervals calculated by Huber-White robust standard errors in brackets.. Each coefficient comes from a separate regression. Regressions with all controls include the following: *Male, Black, Coloured, Age, Home language English, Household size, Female-headed household, Mother's education level, Mother's education missing, Per capita income (Rands).*

* p<0.1, ** p<0.05, *** p<0.01